

OWNER'S MANUAL

Cat. No. 22-214A

43-RANGE MULTITESTER

PLEASE READ BEFORE USING THIS EQUIPMENT



MICRONTA®

FEATURES

This high-sensitivity MICRONTA Multitester is designed to measure AC and DC voltages, DC current and resistance with accuracy and ease.

The range doubler switch (V-A/2 - V-Ω-A) effectively doubles the number of AC and DC scales available. This means you can obtain meter readings in the upper half of the scale, resulting in more accuracy.

The lowest DC ranges - 125mV and 25μA - are great for solid-state circuit work.

The sensitive 18μA meter movement with 4-1/2" face and mirrored scale makes accurate reading a simple matter. The meter scales are in three colors for rapid identification.

The meter circuit incorporates diodes and a fuse to protect the delicate meter movement and other internal parts in case of short-term inadvertent overload or improper function selection.

A special audible continuity function has been incorporated. When using this function, a built-in buzzer will sound when the circuit continuity is approximately 300 ohms or less.

The large, single-knob range/function control is easy to use and read.

An off position is provided to ensure meter protection during transit by shunting the meter movement.

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Features

The handle can be flipped around to the back to support the tester at an easy-to-read angle.

These features combined with rugged design and quality parts ensure you of many years of accurate measurements.

Caution: Permanent damage can occur to your Multitester from exceeding the specified limits or attempting to make measurements with the range switch in wrong position.

WARNING : USE EXTREME CAUTION IN THE USE OF THIS DEVICE. IMPROPER USE OF THIS DEVICE CAN RESULT IN INJURY OR DEATH. FOLLOW ALL SAFEGUARDS SUGGESTED IN THE OWNER'S MANUAL IN ADDITION TO NORMAL SAFETY PRECAUTIONS IN DEALING WITH ELECTRICAL CIRCUITS. **DO NOT** USE THIS DEVICE IF YOU ARE UNFAMILIAR WITH ELECTRICAL CIRCUITS AND TESTING PROCEDURES. NOT FOR COMMERCIAL OR INDUSTRIAL USE.

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SPECIFICATIONS			
Ranges	: 43	Decibel	: -20 to +62 dB in 8 ranges
DC Voltage	: 0-125-250mv - 1.25-2.5-5-10-25- 50-125-250-500- 1000 volts	Accuracy	
AC Voltage	: 0-5-10-25-50-125- 250-500-1000 volts	DC Voltage	: ±3% of full scale value except as noted below
DC Current	: 0-25-50 μ A-2.5-5- 25-50-250-500mA- 5-10 amperes		: ±4% of full scale value for 0.125 to 2.5 volts, 500 and 1000 volts
Resistance	: 0-2K-20K-2 Meg-20 Meg ohms (center scale 10)	AC Voltage	: ±4% of full scale value
Buzzer Continuity	: Approx. less than 300 ohms	DC Current	: ±3% of full scale value
		Resistance	: ±3% of full scale length

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		Specifications	
Sensitivity	: DC: 50,000 ohms/volt (V-A/2) or 25,000 ohms/volt (V- Ω -A) AC: 10,000 ohms/volt (V-A/2) or 5,000 ohms/volt (V- Ω -A)	Test Leads	: Banana plug style (Cat. No. 278-704)
		Fuse	: 0.75A 250V
		Dimensions (HxWxD)	: 6-11/16" x 4-7/8" x 2-3/8" (170x124x60 mm)
Meter Movement	: 4-1/2", 3-color, mirrored scale, 18 μ A full scale	Weight	: 1 lb 3oz (550g)
Batteries	: Requires one 1.5V AA penlight battery and one 9-volt rectangular type battery		

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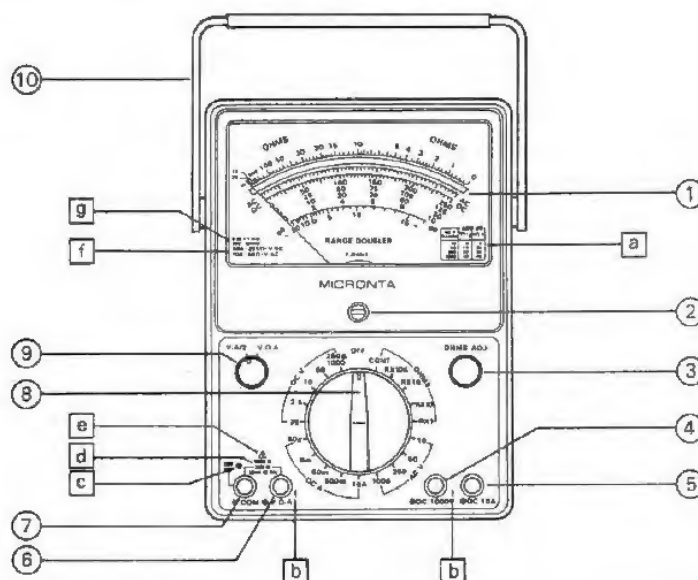
CONTROLS AND FUNCTIONS

- | | |
|--------------------------------------|--|
| 1. Scale _____ | For ACV, DCV, OHMS, DCA and dB readings. Look at the scale from the point where the pointer and its reflection in the mirror come together. |
| 2. Zero Adjust Screw _____ | Use to rest the pointer exactly over "0" at the left side of the AC/DC scale. |
| 3. OHMS ADJ. Control _____ | Use to bring the pointer to "0" on the OHMS scale when measuring resistance. |
| 4. ⊕ DC 1000V Jack _____ | Use only when measuring DC voltage of 250 to 1000V. |
| 5. ⊕ DC 10A Jack _____ | Use only when measuring DC current of above 500 mA. |
| 6. ⊕ V-Ω-A Jack _____ | Connect red lead (+) for all measurements except DC voltage measurement above 250V and DC current measurement above 500mA. |
| 7. ⊖ COM Jack _____ | Connect black (-) lead for all measurements. |
| 8. Range Switch _____ | Turn the knob so that the white mark on the rim points the position that results in a meter reading in the upper 1/2 or 1/3rd of the scale. Set to OFF when the meter is not in use. |
| 9. Range Doubler Switch _____ | Use the V-A/2 position to divide the range switch setting by two. For resistance measurements, use only the V-Ω-A position. See "Using Range Doubler Switch." |

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Controls & Functions

- 10. Handle** ————— Flip around to the back to support the meter at an easy-to-read angle.



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Controls & Functions

Explanation of Special Panel Markings

a

AC V RANGE	ADD dB	
	VA/2	VO A
10	0	6
50	14	20
250	28	34
1000	40	46



Special markings have been added to the panel to remind you of safety.

a. Add the appropriate number in this chart to the dB scale reading. See "Decibel Measurements."

b. Be extra careful when making measurements for high voltage; do not touch terminals or probe ends.

c. To avoid electrical shock and/or instrument damage, do not connect the common input terminal (-jack) to any source of more than 500 volts with respect to earth/ground.

d. The maximum voltage or current that can be measured between these terminals is 1000V AC, 250V DC and 500mA DC.

e. Refer to the following complete operating instructions.

f. The inner resistance of this tester is 50 kohm (DC) or 10 kohm (AC) per volt with the Range Doubler Switch in the V-A/2 position; 25 kohm (DC) or 5 kohm (AC) per volt with the Range Doubler Switch in the V-Ω-A position.

g. 0 dB means that 1 milliwatt is dissipated in a 600 ohm impedance.

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Battery Installation

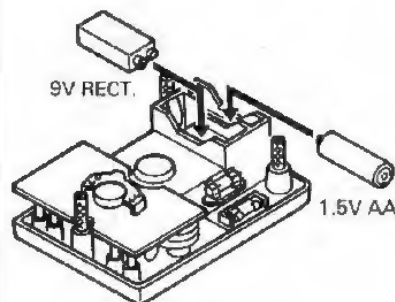
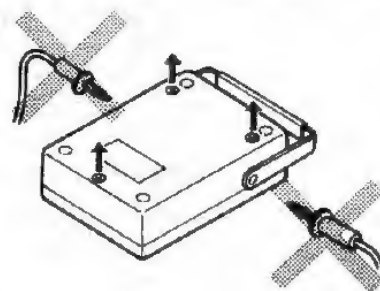
SETTING UP YOUR METER

You will need to install one 9-volt battery for the 20 Megohm ($R \times 10K$) range and continuity range, and one AA 1.5V penlight battery for other resistance ranges. We recommend our 23-583/553 for 9V, 23-582/552 for AA.

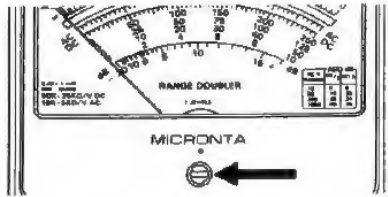
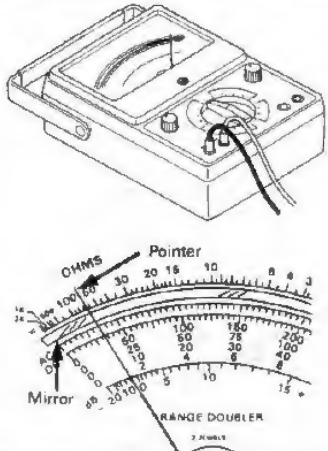
Be sure that the test leads are disconnected.

Open the cabinet by removing the 3 screws from the back and install the batteries in the correct compartments. Observe proper polarity. Close the cabinet and tighten the screws.

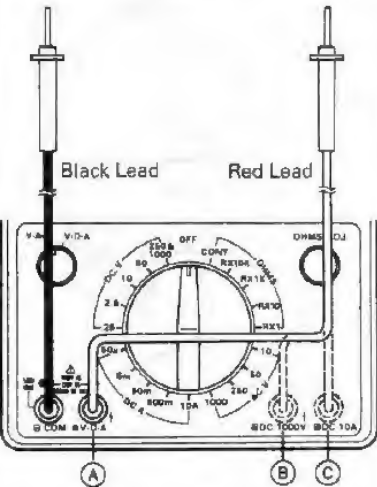
Remember: Never leave weak or dead batteries in your unit. Even "leak-proof" ones may leak damaging chemicals. Also, if you are not going to use your unit for a week or more, remove the batteries.



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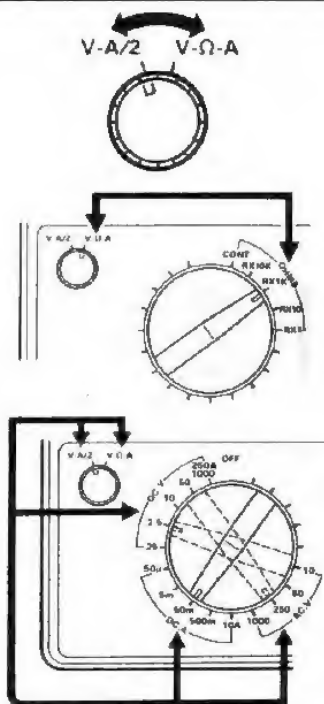
Setting up Your Meter	Zero Adjustment
	<p>If the pointer does not normally rest exactly over "0" at the left side of the scale, adjust the plastic screw in the lowest center of the meter face to bring the pointer to "0"</p>
	<h3 data-bbox="662 491 878 527">Meter Reading</h3> <p data-bbox="662 576 1382 697">For most accurate readings, keep the meter lying flat on a non-metallic surface. Also, use a range and range doubler switch setting that results in a reading in the upper 1/3rd of the meter scale.</p> <p data-bbox="662 761 1382 853">To read the scale, look at it from the point where the pointer and its reflection in the mirror come together; otherwise, the parallax will cause an error in the reading.</p>

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Using Test Leads	Setting up Your Meter
<p>Use only the same type of test leads as are supplied with your unit. These test leads are rated for 1200 volts; replacements are available from your local Radio Shack store. (Cat. No. 278-704)</p> <p>CAUTION: Although these test leads (Cat.No.278-704) are rated for 1200V, the maximum rating of this meter is 1000V. You should not attempt to measure any voltage greater than 1000V.</p> <p>Always observe correct test lead polarity when making DC measurements: The black lead should always be connected to the \ominus COM jack. Connect the red lead to (A) (+ V-Ω-A) for making DC measurements up to 250V, DC current up to 500mA, all AC voltage and resistance measurements; connect it to (B) (+DC 1000V) when measuring DC voltage from 250V to 1000V; and connect it to (C) (+ DC 10A) when measuring DC current from 500mA to 10A.</p> <p>NEVER ALLOW YOUR FINGERS TO TOUCH THE BARE METAL PART OF THE TEST PROBES (OR CIRCUIT POINTS).</p> <p>For safety's sake, disconnect the leads from the circuit under test as soon as you have completed measurements.</p>	

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Setting up Your Meter



Using Range Doubler Switch

For resistance measurements, always use the V-Ω-A position.

When using the V-A/2 position for all other functions, divide the range switch setting by 2 and read on an appropriate scale.

Examples:

1. Range switch is set to 250 V AC and range doubler switch is set to V-A/2. — The range is 125 volts (250 divided by 2) and you should read the red scale, following the 0 to 125 markings.

2. Range switch is set to 10A and range doubler switch is set to V-A/2. (Black lead is plugged in - COM and red lead in + DC 10A.) — The range is 5 amperes (10 divided by 2) and you should read the black scale, following the 0 to 50 markings.

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DC Voltage Measurements

WARNING: USE EXTREME CARE WHEN MAKING HIGH VOLTAGE MEASUREMENTS; DO NOT TOUCH TERMINAL OR PROBE ENDS.

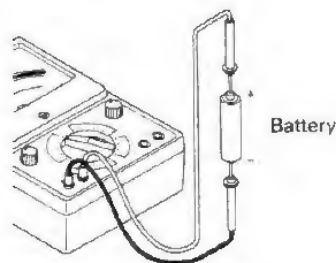
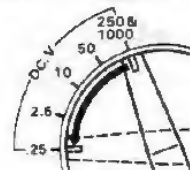
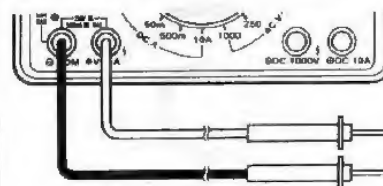
1. Plug the black lead into ⊖ COM and the red lead into ⊕ V-Ω-A jack.

2. Set the range switch to one of the DC V positions; it is best to start at the highest range and work down.

If you are uncertain about the level of voltage, start with the 1000 volt range. See step 6 on next page.

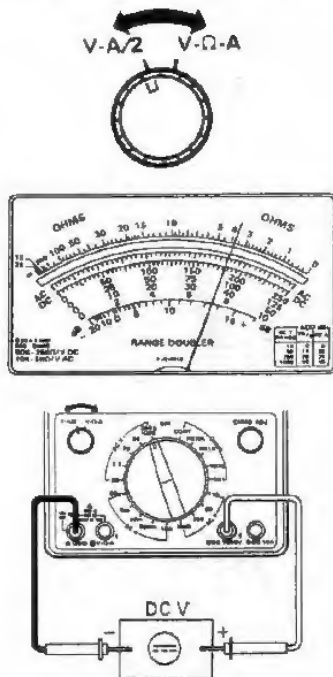
3. Connect the test probe tips to the circuit under test; be sure to observe correct polarity.

MAKING MEASUREMENTS



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Making Measurements



4. Set the range and the range doubler switches as required to obtain a meter reading in the upper 1/2 or 1/3rd of the scale.

5. Read the voltage on the black DC scales.

If the range doubler switch is in the V-A/2 position, be sure to divide the range switch setting by 2 and read on the appropriate scale.

6. For voltages between 250 and 1000, set the range switch to 250 & 1000 and plug the red lead into ⊕ DC 1000V jack.

For voltages between 250 and 500, set the range doubler switch to V-A/2. (The range is then 500 volts.)

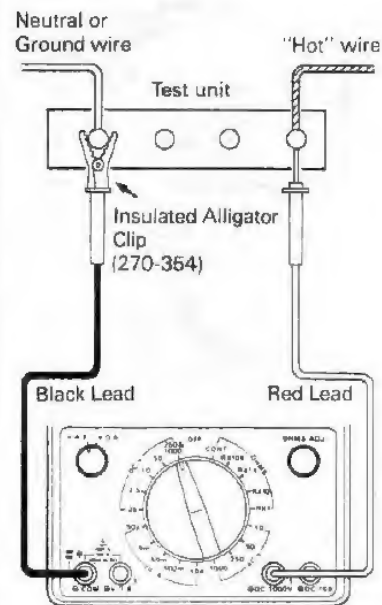
For voltages between 500 and 1000, set the range doubler switch to V-Ω-A. (The range is then 1000 volts.)

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Making Measurements

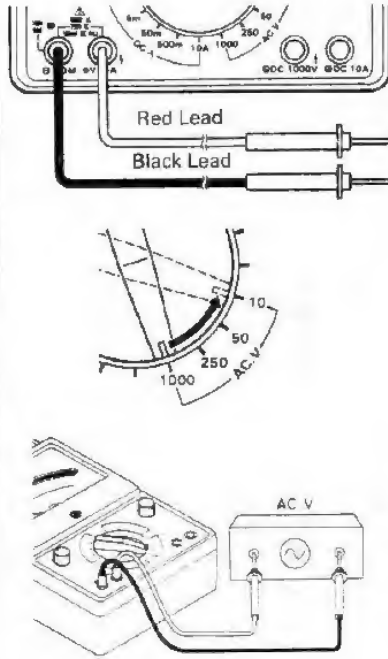
Note: The ⊕ DC 1000V jack is for use only with DC voltages of 250 to 1000V. USE EXTREME CARE WHEN USING THESE HIGH-VOLTAGE RANGES.

Hints: When you use the tester to probe for a voltage in a high voltage circuit, we recommend that you do not try to position both of the probes at once. Instead, you should clamp one of the leads to the neutral or ground lead of the circuit (usually a bare, green or white lead in AC wiring circuit) using our Insulated Slip-On Alligator Clips (Cat. No. 270-354), and then probe for voltages with the other probe. This helps to prevent you from accidentally touching a "hot" wire, since you need only concentrate on one test probe. Never clamp on to a "hot" wire, (usually red, black or blue in AC wiring circuit), since if you did so and then touched the other probe connected to the meter, you could receive an electric shock.



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Making Measurements



AC Voltage Measurements

WARNING: USE EXTREME CARE WHEN MAKING HIGH VOLTAGE MEASUREMENTS; DO NOT TOUCH TERMINAL OR PROBE ENDS.

1. Plug the black lead into \ominus COM and the red lead into \oplus V-Ω-A.

2. Set the range switch to one of the ACV positions. It is best to start at the highest range and work down.

3. Connect the test probe tips to the circuit under test.

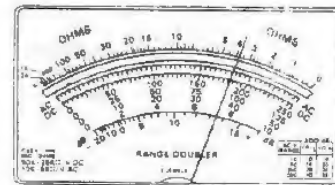
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Making Measurements

4. Set the range and the range doubler switches as required to obtain a meter reading in the upper 1/2 or 1/3rd of the scale.

5. Read the voltage on the red AC scale, following black numbers printed below the red scale.

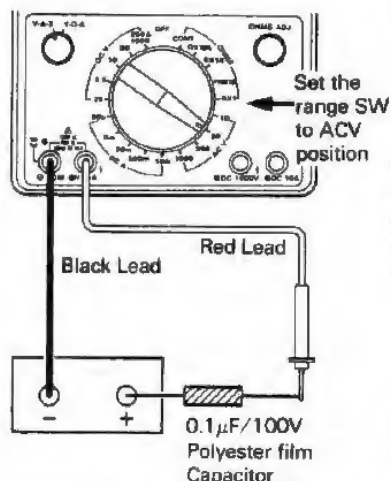
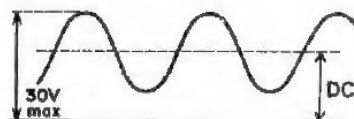
If the range doubler switch is in the V-A/2 position, be sure to divide the range switch setting by 2 and read the appropriate scale.



- Above scale reads 180 volts if the range is set to 250V with range doubler switch set at V-Ω-A.

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Making Measurements



AC Voltage Riding on a DC Source Bias Measurements

Note: When measuring an AC voltage superimposed on a DC voltage source bias, ordinary measurements cannot be made. Under such conditions, if you know the approximate voltage of the device to be measured and the voltage is **UNDER 30V DC/AC**, you can measure the voltage by connecting a 0.1 μ F/100V polyester film capacitor in series with the positive terminal of the voltage source and the (+) test lead. The range switch is set to ACV.

WARNING: NEVER ATTEMPT TO MEASURE OVER 30V AC ON DC SOURCE BIAS.

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Measuring 3-Phase AC Voltages

This tester is designed primarily to measure household AC voltages. When measuring 3-phase circuits line-to-line, the value of the voltage will actually be higher than the rated line-to-ground 3-phase voltage. It is important that you do not exceed the maximum RMS AC rating of this meter, which is 1000VAC.

To determine the RMS voltage line-to-line on a 3-phase line, multiply the rated line-to-ground voltage by the square root of 3 (approx. 1.732).

For example, on a "600-volt 3-phase line" (i.e. 600V line-to-ground), the total available voltage line-to-line is 600×1.732 , or approximately 1039 VAC. This exceeds the rating of this tester. Severe damage as well as a dangerous shock hazard could result if the meter were connected to this circuit.

Making Measurements

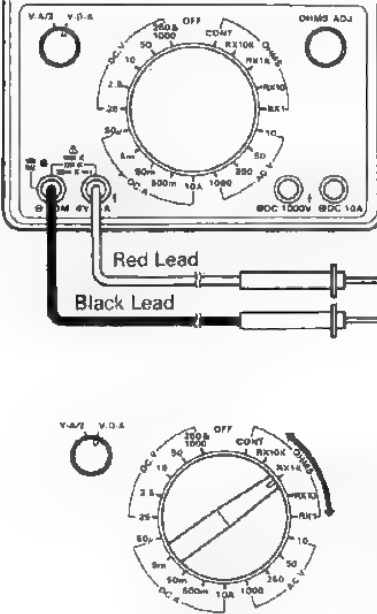
Watch for 3-phase circuits line-to-line.



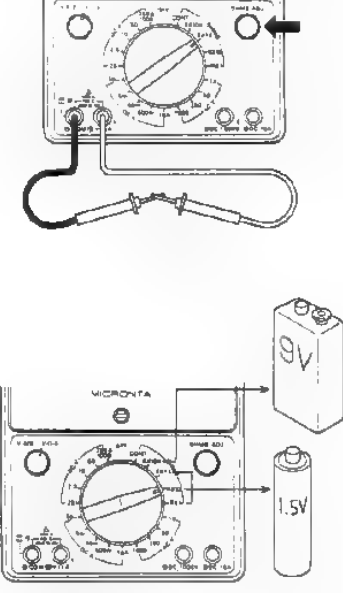
The voltage will be higher.

Remember 1000VAC is maximum.

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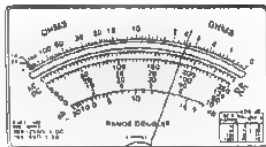
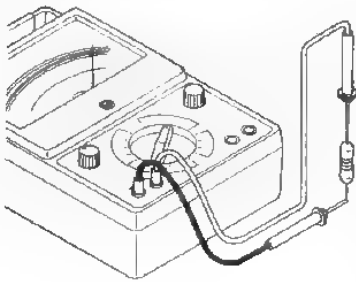
Making Measurements	Resistance Measurements
	<p>WARNING: DO NOT APPLY VOLTAGE TO TEST LEADS WHEN THE RANGE SWITCH IS IN OHMS POSITION.</p> <p>BEFORE TAKING ANY RESISTANCE MEASUREMENTS, DISCONNECT POWER TO THE UNIT UNDER TEST AND DISCHARGE THE CAPACITORS. It is best to remove any batteries (from unit under test) and unplug line cords.</p> <ol style="list-style-type: none"> 1. Plug the black lead into \ominus COM and the red lead into \oplus V-Ω-A jack. 2. Leave the range doubler switch in the V-Ω-A position. <p>THE RANGE DOUBLER SWITCH MUST BE LEFT IN THE V-Ω-A POSITION FOR ALL RESISTANCE MEASUREMENTS.</p> <ol style="list-style-type: none"> 3. Set the range switch to one of the OHMS positions.

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	Making Measurements
<ol style="list-style-type: none"> 4. Touch the test probe tips together and adjust the OHMS ADJ. control to bring the pointer to "0" on the top (green) OHMS scale. <p>If you cannot adjust the pointer to "0" on the OHMS scale when you short the test leads together, replace the battery with a new one.</p> <p>When you are unable to adjust the pointer to "0" on the OHMS scale in the $R \times 1$, $R \times 10$, or $R \times 1K$ positions, the 1.5V penlight battery must be replaced.</p> <p>When you are unable to adjust the pointer to "0" on the OHMS scale when in the $R \times 10K$ position, replace the 9-volt battery.</p> <p>See "REPLACEMENT OF BATTERY/FUSE."</p>	

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Making Measurements



5. Connect the probe tips across the circuit or part under test.

When measuring resistance, it is best to disconnect one side of the component under test so the remainder of the circuit will not interfere with the readings.

6. Read the resistance on the green OHMS scale.

Use the proper multiplier to obtain the correct value (R "times" 1, 10, 1000, or 10,000 depending on the position of the range switch).

Note for Testing Semiconductor Junctions: When attempting to identify cathode and anode ends or the type of transistor (PNP or NPN), the actual polarity of the tester's voltage is opposite of the lead colors. The red lead is the negative source. The black lead is positive.

Continuity Check

1. Plug the black lead into \ominus COM and the red lead into \oplus V- Ω -A.

2. Set the range switch to the CONT position on the OHMS range.

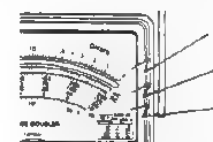
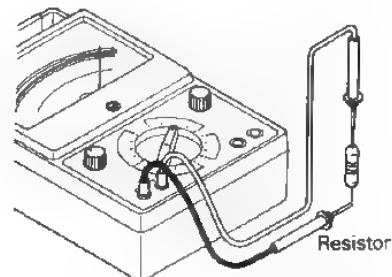
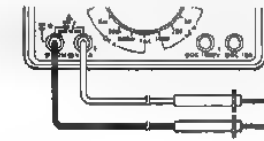
3. Leave the range doubler switch in the V- Ω -A position.

4. Connect the test leads to the unit under test.

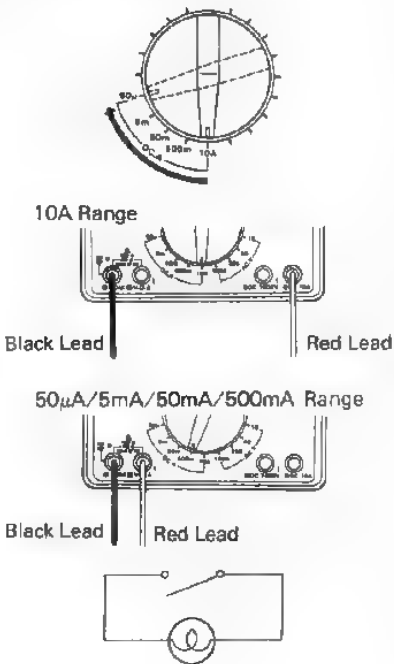
5. If the resistance is 0 to 300 ohms (approx.), the built-in buzzer sounds. The level of the sound reduces as the resistance increases.

Note: If the buzzer does not sound when you short the test leads, replace the 9-volt battery.

Making Measurements



Making Measurements



DC Current Measurements

To measure current, you must break the circuit and connect the leads in series with the circuit.

WARNING: DO NOT APPLY VOLTAGE TO THE TEST LEADS WHEN THE RANGE SWITCH IS IN THE CURRENT POSITION.

1. Set the range switch to one of the DCA positions. Always start at the highest range and work down.

2. **For 10A measurement:** Plug the red lead into ⊕DC 10A and the black lead into ⊖COM.

For 50μA/5mA/50mA/500mA measurements: Plug the red lead into ⊕V-Ω-A and the black lead into ⊖COM.

3. Remove power from the circuit under test and then break the circuit at the appropriate point.

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Making Measurements

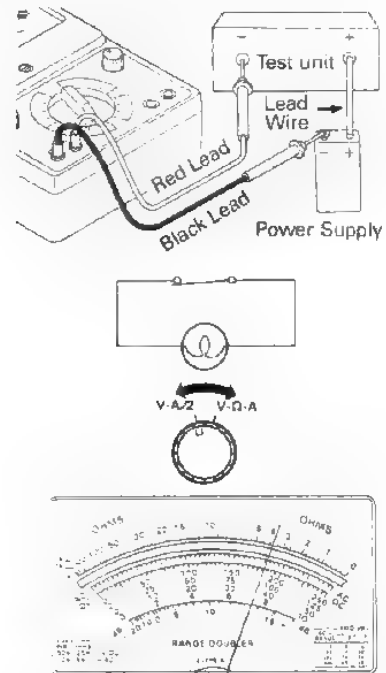
4. Connect probes to the circuit in series. (black lead to the negative side and the red lead to the positive side).

5. Apply voltage to the circuit under test.

6. Set the range and the range doubler switches as required to obtain a meter reading in the upper 1/2 or 1/3rd of the scale.

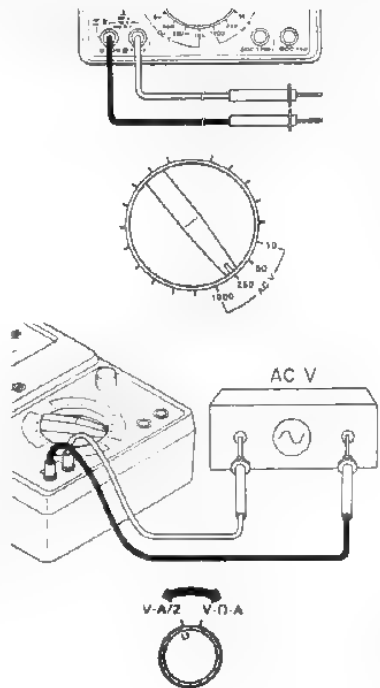
7. Read the current on the black DC scales.

If the range doubler switch is in the V-A/2 position, be sure to divide the range switch setting by 2 and read the appropriate scale.



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Making Measurements



Decibel Measurements

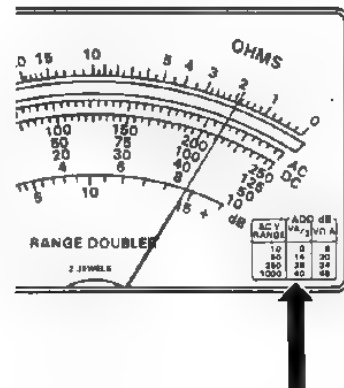
1. Plug the black lead into \ominus COM and red lead into \oplus V-Ω-A.
2. Set the range switch to one of the ACV positions; it is best to start at the highest range and work down.
3. Connect the test probe tips to the circuit under test.
4. Set the range and range doubler switches as required to obtain a meter reading in the upper 1/2 or 1/3rd of the dB scale.

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Making Measurements

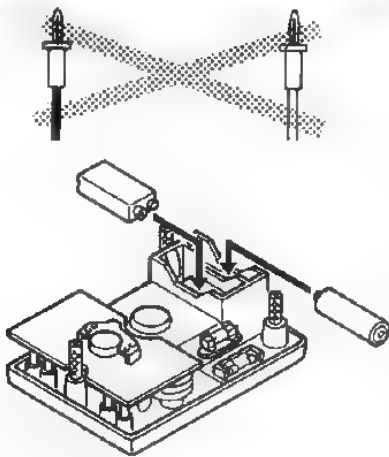
5. Read dB on the dB scale, adding the appropriate number of dB to the dB scale reading as noted on the chart at the lower right on the meter face.

Note: For absolute dB measurements, circuit impedance must be 600 ohms.
0 dB = 1 milliwatt dissipated in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).



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REPLACEMENT OF BATTERY/FUSE



WARNING: TO AVOID ELECTRIC SHOCK, DISCONNECT THE TEST LEADS BEFORE REMOVING THE BATTERY OR FUSE. REPLACE ONLY WITH THE SAME TYPE BATTERY OR FUSE. OPEN THE CABINET ONLY WHEN REPLACING THE BATTERY OR FUSE. DO NOT TOUCH ANY AREA INSIDE THE CASE OTHER THAN BATTERY OR FUSE.

CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH **0.75A, 250V** FUSE SUCH AS OUR CAT. NO. 270-1272.

Note: The fuse will blow when voltage is applied when tester is in OHMS range, or current range (except 10A range), or when excess voltage is applied to 0.25 DCV/ 0.125DCV range. When the fuse blows, there will be no deflection of meter.

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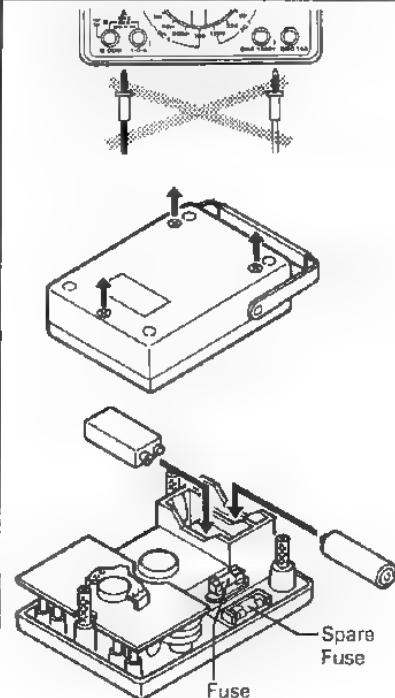
To install or replace the battery or fuse:

1. Disconnect the test leads.
2. Open the cabinet by loosening three screws on the back.

3. Replace the battery if necessary.

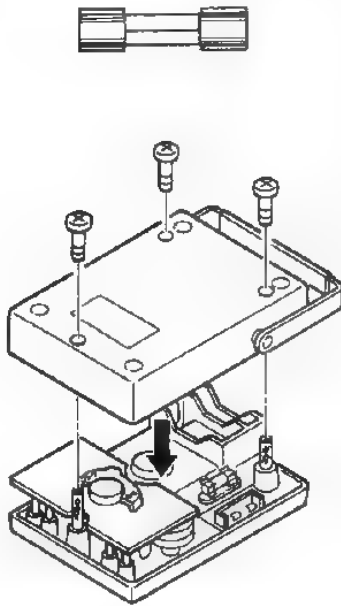
Install one 9 V battery such as our Cat.Nos.23-583/553 and one AA 1.5V penlight battery such as our Cat. Nos. 23-582/552. Observe correct polarity.

Replacement of Battery/Fuse



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Replacement of Battery/Fuse



4. If the fuse has blown, remove it.

5. Insert ■ new fuse, using only one of the same type/rating (0.75A, 250V/Cat. No. 270-1272). One spare fuse is supplied with your Multitester inside the cabinet.

6. Close the cabinet and replace the screws.

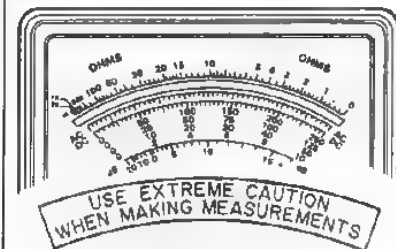
WARNING: DO NOT OPERATE THE UNIT UNTIL THE CABINET IS FULLY CLOSED.

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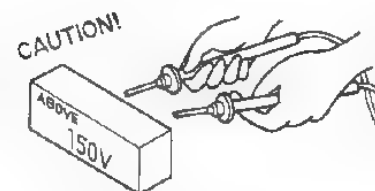
GOOD METER MEASUREMENT PRACTICES

Here are some good general rules that apply to the use of electrical meters. Some are common-sense; others are important safety precautions.

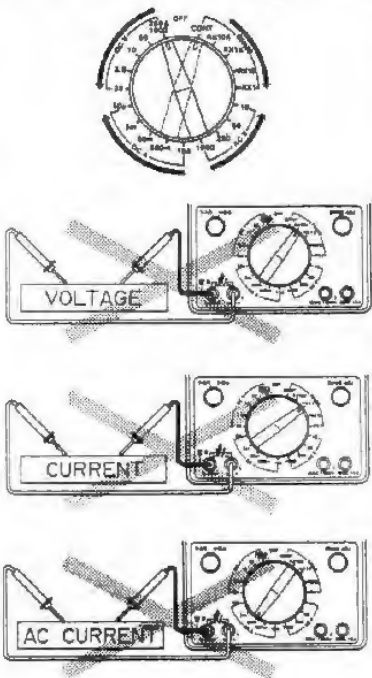
1. There is always the possibility of dangerous voltages being present in any piece of electrical/electronic equipment. Always use extreme caution when making measurements - high voltage may appear at unexpected points in a suspected defective circuit.
2. Never attempt to measure voltage or current above the specified maximum the Multitester is designed for; the maximum input limit for voltage and current measurement between \oplus V- Ω -A and \ominus COM is 1000V AC, 250V DC and 500mA DC.
3. Exercise extreme caution when measuring voltages of 150V and above.



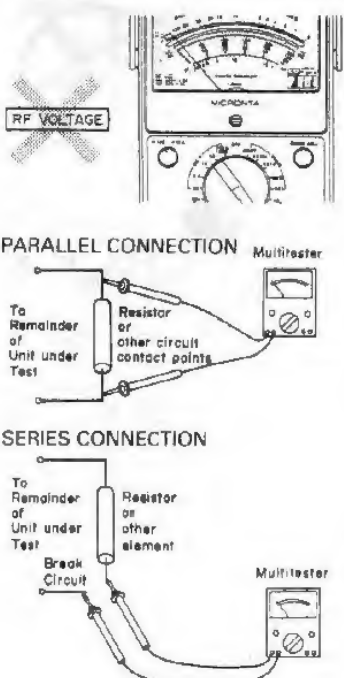
~~1000V AC~~
~~ABOVE 250V DC~~
~~500mA DC~~



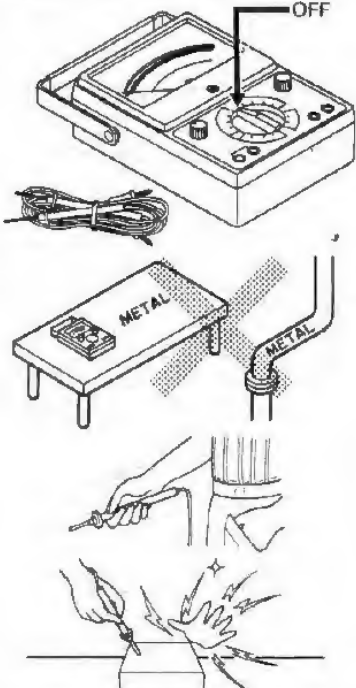
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Good Meter Measurement Practices	
	<p>4. When making voltage and current measurements always start with the highest range available.</p> <p>5. Never attempt to measure a voltage when the function is set to resistance or current. (It may burn out the meter movement or other circuitry.)</p> <p>6. Never attempt to measure current with the tester set for resistance.</p> <p>7. Never attempt to measure AC voltages or current with the tester set to a DC mode. (Meter circuitry can be damaged.)</p>

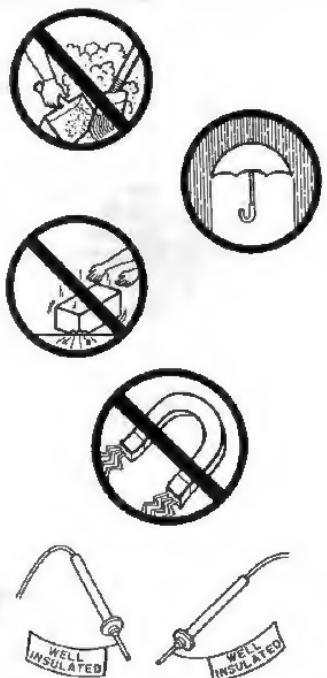
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	Good Meter Measurement Practices
<p>8. Do not attempt to measure RF voltages with the Multimeter. (It can be damaged, or, at best, the readings will be meaningless.)</p> <p>9. Remember that voltage and resistance measurements are made with the Multimeter connected in parallel. Current measurements are made with the Multimeter connected in series.</p>	 <p>RF VOLTAGE</p> <p>PARALLEL CONNECTION</p> <p>To Remainder of Unit under Test</p> <p>Resistor or other circuit contact points</p> <p>Multimeter</p> <p>SERIES CONNECTION</p> <p>To Remainder of Unit under Test</p> <p>Resistor or other element</p> <p>Break Circuit</p> <p>Multimeter</p>

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Good Meter Measurement Practices	
	<p>10. When the Multitester is not in use, always leave the range switch in the OFF position.</p> <p>11. When making measurements, never stand on a wet or damp floor. Do not work on or even near any grounded metal object — for example, a metal work table, metal water or gas pipes, metal electrical conduit. Accidental contact between the grounded metal object and the circuit under test can be lethal.</p> <p>12. Get into the habit of keeping one hand in your pocket when troubleshooting any equipment containing high voltage circuitry.</p> <p>13. You should remember that even a small shock can be dangerous, because your body's reaction to a minor shock can cause you to bump or fall against a higher voltage contact.</p>

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	Good Meter Measurement Practices
<p>14. Do not expose your meter to moisture; avoid high humidity and excessive dust and dirt.</p> <p>15. Avoid vibration or mechanical shock; the Multitester might be damaged or its accuracy affected.</p> <p>16. Avoid using meters in locations with high magnetic fields. (Inaccurate measurements can result.)</p> <p>17. Always use only well insulated test leads. Never use test leads with frayed or broken insulation.</p>	

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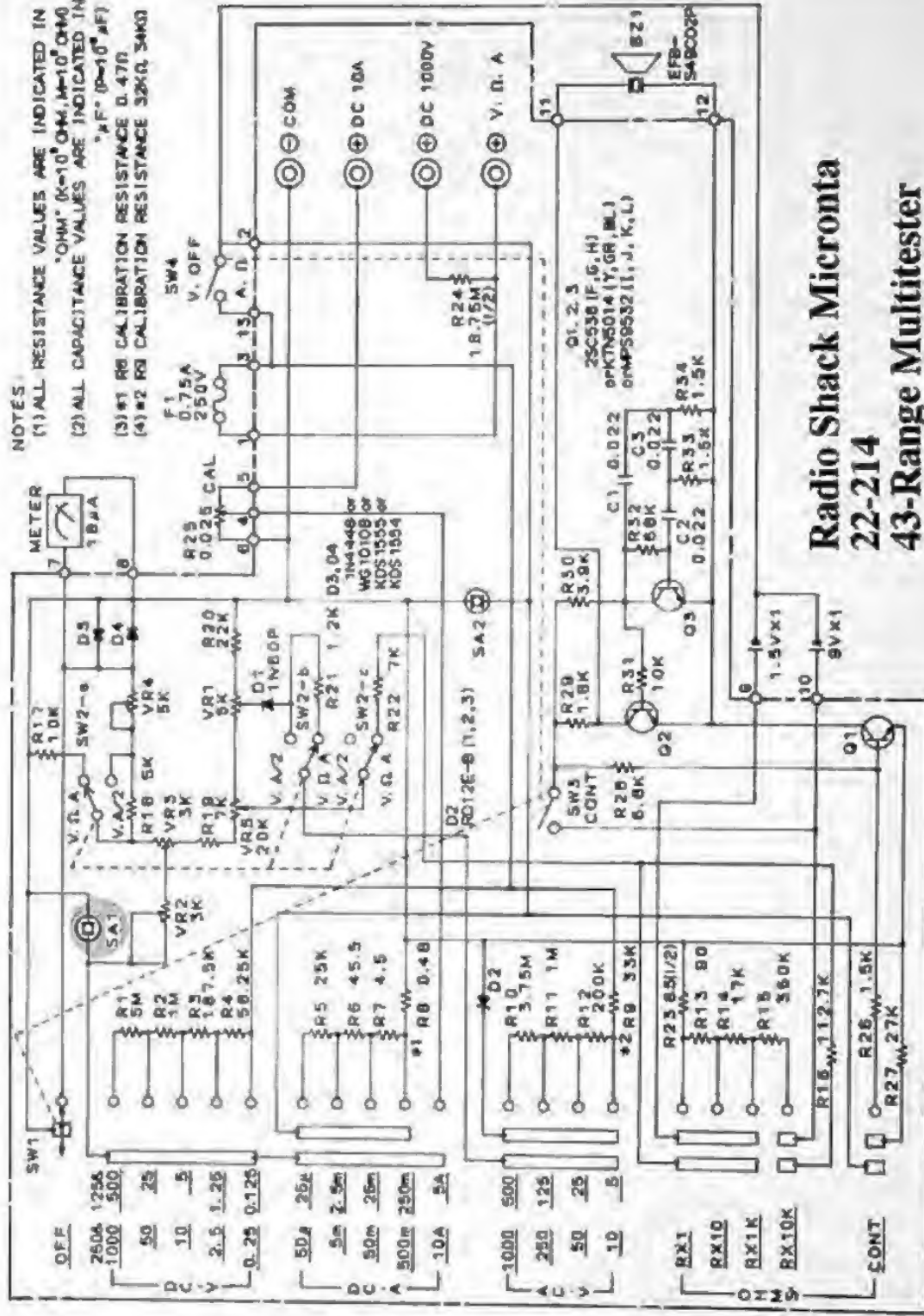
RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply bring your Radio Shack sales slip as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

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NOTES: (1) ALL RESISTANCE VALUES ARE INDICATED IN "OHM" ($K=10^3$ OHM, $M=10^6$ OHM).
(2) ALL CAPACITANCE VALUES ARE INDICATED IN "PF" ($\mu=10^{-6}$ F).

CAUTION: SINCE THE COMPONENTS MARKED BY Δ ARE CRITICAL FOR SAFETY, USE ONLY THOSE DESCRIBED ON PARTS LIST.

Schematic subject to change without notice.

For most accurate Schematic (and parts) contact Radio Shack, National Parts Dept., Fort Worth TX 76101.